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CLAIMS

[Claim(s)]
[Claim 1]A trestle part which is supported by support base movable and performs rough alignment to optometry-ed.
An optical system moving section supported movable for right and left and up-and-down all directions approximately having a crevice between this trestle part.
A detection means to be the ophthalmology device provided with the above and to detect existence of a foreign matter in a crevice between said trestle part and an optical system moving section, An optical system actuator which drives said optical system moving section respectively for order, right and left, and up-and-down all directions, and performs fine alignment to optometry-ed, A control means which changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section was established based on a detection result of a foreign matter by said detection means.

[Claim 2]A trestle part which is supported by support base movable and performs rough alignment to optometry-ed.
An optical system moving section supported movable for right and left and up-and-down all directions approximately having a crevice between this trestle part.
An optical system actuator using a DC motor which is the ophthalmology device provided with the above, drives said optical system moving section respectively for order, right and left, and up-and-down all directions, and performs fine alignment to optometry-ed, An overcurrent detecting means which detects an over-current to said DC motor which flows with invasion of a foreign matter to a crevice between said trestle part and an optical system moving section, A control means which changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section was established based on a detection result of an over-current by said overcurrent detecting means.

[Claim 3]A trestle part which is supported by support base movable and performs rough alignment to optometry-ed.
An optical system moving section supported movable for right and left and up-and-down

all directions approximately having a crevice between this trestle part.
Are the ophthalmology device provided with the above and respectively to said optical system moving section Before or after, An optical system actuator using a motor and a clutch mechanism which give driving force for right and left and up-and-down all directions, and perform fine alignment to optometry-ed is provided, At the time of invasion of a foreign matter to a crevice between said trestle part and an optical system moving section, transfer of driving force from said motor to an optical system moving section was buffered according to said clutch mechanism.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to ophthalmology devices, such as a refractometer, keratometer, etc. which perform the rough alignment and fine alignment to optometry-ed of a device main frame, and perform examining-the eyes measurement [ophthalmology], in more detail about an ophthalmology device.
[0002]
[Description of the Prior Art]the ophthalmology device which has what is called an automatic alignment function conventionally -- that is, The catoptric light from the cornea of the alignment-index light projected on optometry-ed is led to the photosensor of a light-receiving optical system, and the ophthalmology device which aligns a device main frame automatically to optometry-ed based on the detect output of this photosensor is known.
[0003]In this ophthalmology device, a ** person moves the measuring beam axis of a device main frame to near an examining-the eyes vertex-corneae point using a joy stick etc., looking at a picture monitor (rough alignment). Completion of rough alignment will perform detailed automatic alignment with a drive unit based on the output of a photosensor (fine alignment). Thereby, a device main frame is arranged to a prescribed position to optometry-ed, and it is made to perform exact ophthalmology measurement.
[0004]The trestle part which such an ophthalmology device is supported movable by the support base established in the device main frame, and performs rough alignment to optometry-ed, Usually it has composition which has an optical system moving section which carries the optical system for optometry supported movable for right and left and up-and-down all directions to this trestle part approximately.
[0005]
[Problem(s) to be Solved by the Invention]However, in order to move an optical system moving section in the case of the conventional ophthalmology device mentioned above, between a trestle part and an optical system moving section, the structure blockaded thoroughly does not become but a certain amount of crevice exists. As a result, in the case where the subject of childhood gets into mischief near this ophthalmology device when setting by sending this ophthalmology device to a show for display, for example etc., The situation where a finger was inserted in said crevice arose, the crevice interval by movement of the optical system moving section to a trestle part became very narrow depending on the case, and there was a danger that the accident in which the amount of driving force to an optical system moving section will carry out a direct action to a finger,

and a finger will be damaged would occur.
[0006]In light of the above-mentioned circumstances, also in the case where it is the contingency that foreign matters, such as fingers, such as subject, are inserted in the crevice between a trestle part and an optical system moving section, this invention avoids the damage over foreign matters, such as a finger, and an object of this invention is to provide the ophthalmology device which can aim at improvement in safety.
[0007]
[Means for Solving the Problem]A trestle part to which the invention according to claim 1 is supported by support base movable, and this invention performs rough alignment to optometry-ed, An ophthalmology device which has the optical system moving section supported movable for right and left and up-and-down all directions is characterized by comprising the following approximately, having a crevice between this trestle part:
A detection means to detect existence of a foreign matter in a crevice between said trestle part and an optical system moving section.
An optical system actuator which drives said optical system moving section respectively for order, right and left, and up-and-down all directions, and performs fine alignment to optometry-ed.
A control means which changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section, based on a detection result of a foreign matter by said detection means.

[0008]According to this invention, when foreign matters, such as a finger of subject, are inserted in a crevice between said trestle part and an optical system moving section, for example, a detection means sends a detection result which shows existence of a foreign matter in this crevice to a control means. A control means changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section, based on a detection result of a foreign matter by a detection means.
[0009]Thereby, also in a case where it is the contingency that foreign matters, such as fingers, such as subject, are inserted in a crevice between a trestle part and an optical system moving section, damage over foreign matters, such as a finger, can be avoided and improvement in the safety of this ophthalmology device can be aimed at.
[0010]A trestle part to which the invention according to claim 2 is supported by support base movable, and this invention performs rough alignment to optometry-ed, An ophthalmology device which has the optical system moving section supported movable for right and left and up-and-down all directions is characterized by comprising the following approximately, having a crevice between this trestle part:
An optical system actuator using a DC motor which drives said optical system moving section respectively for order, right and left, and up-and-down all directions, and performs fine alignment to optometry-ed.
An overcurrent detecting means which detects an over-current to said DC motor which flows with invasion of a foreign matter to a crevice between said trestle part and an optical system moving section.
A control means which changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle

part and an optical system moving section, based on a detection result of an over-current by said overcurrent detecting means.

[0011]According to this invention, when foreign matters, such as a finger of subject, are inserted in a crevice between said trestle part and an optical system moving section, for example, foreign matters, such as a finger, are pushed in said crevice by driving force of said DC motor, and an over-current flows into said DC motor, but. Since an overcurrent detecting means detects this state and a control means changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section, based on a detection result of an overcurrent detecting means, Also in a case where it is the contingency that foreign matters, such as fingers, such as subject, are inserted in a crevice between a trestle part and an optical system moving section, thrust to foreign matters, such as a finger, can be eliminated, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at.
[0012]A trestle part which the invention according to claim 3 is supported by support base movable, and performs rough alignment to optometry-ed, In an ophthalmology device which has the optical system moving section supported movable for right and left and up-and-down all directions approximately having a crevice between this trestle part, An optical system actuator using a motor and a clutch mechanism which give driving force for right and left and up-and-down all directions, and perform fine alignment to optometry-ed is respectively provided to said optical system moving section approximately, At the time of invasion of a foreign matter to a crevice between said trestle part and an optical system moving section, transfer of driving force from said motor to an optical system moving section was buffered according to said clutch mechanism.
[0013]Since according to this invention transfer of driving force from said motor to an optical system moving section was buffered according to said clutch mechanism when foreign matters, such as a finger of subject, invaded into a crevice between said trestle part and an optical system moving section, for example, An operation of excessive thrust to foreign matters, such as a finger, can be eased, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at too.
[0014]
[Embodiment of the Invention]Below, an embodiment of the invention is described in detail.
[0015](Embodiment 1) Drawing 1 is an outline view of the ophthalmology device which has a function of both the keratometer which is an example of an embodiment of the invention, and a refractometer.
[0016]As shown in drawing 1, this ophthalmology device is provided with the following.
The support base 100 which consists of the fixed base 101 and the moving base 102 where the device power which is not illustrated was built in.
The trestle part 103 provided with the indicator 82 which has been arranged on the moving base 102 of this support base 100 and which is mentioned later.
The optical system moving section 104 arranged movable in X (right and left) directions shown in drawing 1 to the trestle part 103 in the upper part of this trestle part 103, the direction of Y (upper and lower sides), and the direction of Z (before or after).

The jaw receptacle implement 105 with which the subject M connected with said fixed base 101 carries a jaw.

[0017]With the moving base 102, said trestle part 103 has become movable to the direction of X, and a Z direction by operation at the control lever 111, and said trestle part 103 is movable in the direction of Y to the moving base 102 by carrying out rotatably operating of the control lever 111. Explanation is omitted about the moving mechanism of the moving base 102 and the trestle part 103 here.
[0018]The operation switch 112 is formed in the center of a crowning of said control lever 111, and examining E-the eyes photography [picture] etc. are performed.
[0019]Drawing 2 shows the optical system of the ophthalmology device of this Embodiment 1, and equips the trestle part 103 and the optical system moving section 104 which are confronted with the optometry E-ed of the subject M with the optical element stated to the following which constitutes the optical path 1 thru/or the optical path 6.
[0020]The optical path 1 is an optical system for projecting the target for eye-refracting-power measurement on the optometry E-ed, and comprises the light source 11, the collimator lens 12, the cone prism 13, the measurement target 14, the relay lens 15, the pupil relay lens 16, the hole difference mirror 17, the mirrors 18 and 19, and the object lens 20.
[0021]The optical path 2 is an optical system for receiving the target image reflected from examining E-the eyes eyegrounds to the area sensor 28, It comprises the object lens 20, the mirrors 19 and 18, the hole difference mirror 17, the pupil relay lens 21, the mirror 22, the relay lens 23, the moving lens 24, the mirrors 25 and 26, the image formation lens 27, and the area sensor 28.
[0022]The optical path 3 is an optical system for observing an examining E-the eyes anterior ocular segment image, and comprises the area sensor 28 which consists of the object lens 20, the mirror 19, the diaphragms 31 and 32, the relay lens 33, the collimator lens 34, the mirror 26, the image formation lens 27, a CCD element, etc.
[0023]The image processing portion 81 which performs image processing of optometry data, and the indicator 82 which performs image display of an image for the eyes to be examined are connected to this area sensor 28.
[0024]The optical paths 4 are the fixation and an optical system for carrying out fog, and the optometry E-ed consists of the light source 41, the collimator lens 42, the fixation target 43, the relay lens 44, the pupil relay lens 45, the mirror 46, the mirror 18, the mirror 19, and the object lens 20.
[0025]The optical path 5 is an optical system for performing distance doubling of the optical axis direction of the optometry E-ed and a main part, It comprises the light source 51 which is in a view for the eyes to be examined and was put in order by ring shape, the diffusion board 52, the ring shape target 53, the light sources 54 and 55 for projecting a parallel pencil on the optometry E-ed and the diffusion boards 56 and 57, the pinholes 58 and 59, and the collimator lenses 60 and 61. The optical path 5 serves also as the optical system for measuring the curvature radius of an examining E-the eyes cornea.
[0026]The optical path 6 is constituted from the optical system for performing alignment of the direction which intersects perpendicularly with the optic axis of the optometry E-ed and a main part by the light source 71, the diffusion board 72, the pinhole 73, the collimator lens 74, the mirror 32, the diaphragm 31, the mirror 19, and the object lens 20.

[0027]Next, with reference to drawing 3 thru/or drawing 6, the joining structure of said trestle part 103 and the optical system moving section 104 in this Embodiment 1 is explained.
[0028]Said trestle part 103 and the optical system moving section 104 covered the whole periphery abbreviation respectively, and are provided with the stand covering 123 and the optical system covering 124.
[0029]The stand covering 123 of said trestle part 103 is provided with the following.
While being constituted so that the wall surface which met in the direction of Y of this trestle part 103 may be covered as shown in drawing 3, it is the flat part 123a to the upper part side of the trestle part 103.
The square tubed rising part 123b which rises to the direction upper part of Y.
And in the opening region of the rising part 123b, said optical system moving section 104 is supported movable to the direction of X, the direction of Y, and the Z direction.
[0030]The optical system covering 124 of said optical system moving section 104 is provided with the following.
The flat upper face part 124a which covers the upper surface of the optical system moving section 104.
It is the wrap square tubed lateral portion 124b about the wall surface which met in the direction of Y of the optical system moving section 104.

[0031]Between said rising part 123b and the lateral portion 124b, the crevice (several millimeters thru/or about about ten mm) G is formed corresponding to the movement magnitude of the optical system moving section 104 to said trestle part 103.
[0032]And the wall surface perimeter of said rising part 123b which faces this crevice G, and the lateral portion 124b was covered, and the contact sensor 125 which does not send current through the foreign matters 150, such as a finger, with an un-energizing type is arranged.
[0033]As the contact sensor 125, the photo sensor which put respectively in a row photo detectors which stuck the insulation sheet on the surface, such as light emitting devices, such as an electrostatic type sensor and LED, and a photo-transistor, to correspondence arrangement, for example is used. The composition arranged to [both sides or either one of] said rising part 123b or a lateral portion 124b can be used for the contact sensor 125.
[0034]Said optical system moving section 104 is driven in the direction of X by the optical system actuator 130 arranged on the trestle part 103, and performs fine alignment to the optometry E-ed.
[0035]Namely, the direction motor 131a of X which consists of a pulse motor arranged on the upper surface of said trestle part 103 as the optical system actuator 130 is shown in drawing 4 and drawing 5, The motivation gear 132 connected with the driving shaft of this direction motor 131a of X is arranged, It meets in the direction of X by the pieces 133 and 134 of a screw receptacle of the couple which protruded on the wall surface which met in the direction of X of the optical system actuator 130, And the screw body 135 which was screwed in the pieces 133 and 134 of these screw receptacles and which was formed cylindrically is arranged, and it has structure which screwed the follower gear 136 attached to the end of this screw body 135, and said motivation gear 132.
[0036]Although the optical system actuator which drives said optical system moving section 104 to the direction of Y and a Z direction is not illustrated, either, it is

considered as the same composition as said optical system actuator 130.
[0037]Drawing 6 shows the principal part of the control system in this Embodiment 1, and it is provided with the control section 140 as a control means which controls said contact sensor 125 and the direction motor 131a of X while it stores the control program about rough alignment, fine alignment, etc. to the optometry E-ed. This control section 140 controls the direction motor 131b of Y and the Z direction motor 131c which constitute each optical system actuator which drives said optical system moving section 104 besides said direction motor 131a of X to the direction of Y, and a Z direction.
[0038]Next, the case where the foreign matters 150, such as a finger of the child of childhood, invade an operation of the ophthalmology device of this Embodiment 1 into the crevice G between said rising part 123b and the lateral portion 124b is mainly carried out, and it explains.
[0039]When the foreign matters 150, such as a finger of the child of childhood, invade into the crevice G between the rising part 123b of said trestle part 103, and the lateral portion 124b of the optical system moving section 104, said contact sensor 125 operates and the detection result which shows existence of the foreign matter 150 is sent to the control section 140. In this case, since said contact sensor 125 is constituted in the un-energizing type, current does not flow into human bodies, such as a finger of the child of childhood, and it excels in safety extremely.
[0040]Based on the detection result from the contact sensor 125, said control section 140 stops said direction motor 131a of X, and loses the thrust to the foreign matters 150, such as a finger. the direction which the control section 140 performs movement to the initial setting position (for example, center position) of said optical system moving section 104 based on the detection result from the contact sensor 125, or keeps away said optical system moving section 104 from the foreign matter 150 -- it is made to move
[0041]Thereby, also in the case where it is the contingency that the foreign matters 150, such as fingers, such as subject, invade into the crevice G between the trestle part 103 and the optical system moving section 104, the thrust to the foreign matters 150, such as a finger, can be eliminated, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at.
[0042]Next, with reference to drawing 7 thru/or drawing 11, the alignment operation which consists of the rough alignment and fine alignment by the ophthalmology device of the above-mentioned composition is explained.
[0043]For example, in the case where the mode which aligns focusing on an examining E-the eyes cornea is chosen by a ** person's operation, the procedure of performing alignment to the optometry E-ed of the trestle part 103 is explained.
[0044]It intersects perpendicularly with the optic axis which the optical system of the trestle part 103 and the optical system moving section 104 forms, for example, auto alignment about the direction of X is performed by the principle expressed below.
[0045]That is, the light flux which was emitted from the light source 71 of the optical path 6, and was ejected from the pinhole 73 is projected as a parallel pencil to the optometry E-ed, and is reflected by the examining E-the eyes cornea.
[0046]The reflected figure of the light flux ejected from the pinhole 73 from a cornea is projected by each optical element of the optical path 3 on the area sensor 28.
[0047]When there is a gap in the optical path 3 and an examining E-the eyes optical axis, it is displayed in the state where it shifted from the center as the reflected figure x of the

light flux ejected from the pinhole 73 to the pupil portion in an examining E-the eyes anterior ocular segment image showed drawing 7.
[0048]When there is no gap in said optical path 3 and an examining E-the eyes optical axis, the reflected figure x of the light flux ejected from the pinhole 73 to the pupil portion in an examining E-the eyes anterior ocular segment image is displayed on the center position, as shown in drawing 8.
[0049]Said reflected figure projected on the area sensor 28 is memorized by the storage parts store 83 of the image processing portion 81, and data processing of the gap with the optic axis of the optical path 3 and an examining E-the eyes optical axis is carried out by the image processing portion 81.
[0050]A ** person performs rough alignment, looking at examining E-the eyes the anterior ocular segment image and the reflected figure x which are observed by the optical path 3 and displayed on the indicator 82.
[0051]And if the reflected figure x goes into a prescribed range, the optical system moving section 104 will be moved based on data processing by said image processing portion 81. Thereby, examining E-the eyes alignment [fine] is completed automatically.
[0052]On the other hand, the alignment to an examining E-the eyes Z direction uses the optical path 5. That is, projection of the light flux from the ring shape target 53 from limited distance and parallel projection of the light flux ejected from the pinholes 58 and 59 are performed by the composition of the optical path 5 to an examining E-the eyes cornea.
[0053]The reflected figure from an examining E-according to two kinds of this projection-the eyes cornea is projected on the area sensor 28 by the optical path 3. When the distance of the optometry E-ed and the main part 50 is in a normal position value, here, The display mode of the reflected figures alpha and beta by the pinholes 58 and 59 displayed on said indicator 82 and the reflected figure y of the ring shape target 53 will be in the state where the reflected figures alpha and beta were in agreement with the circumference section of the reflected figure y by arrangement 180 degrees, as [show / in drawing 9].
[0054]When the distance of the optometry E-ed and the trestle part 103 is too nearer than a normal position value, The display mode of the reflected figures alpha and beta by the pinholes 58 and 59 displayed on said indicator 82, and the reflected figure y of the ring shape target 53, As shown in drawing 10, it spreads rather than the case where the reflected figure y of the ring shape target 53 shows drawing 9, and the reflected figures alpha and beta by the pinholes 58 and 59 will be in the state where it is located inside the reflected figure y.
[0055]When distance with the optometry E-ed is too further than a normal position value, The display mode of the reflected figures alpha and beta by the pinholes 58 and 59 displayed on said indicator 82, and the reflected figure y of the ring shape target 53, As shown in drawing 11, it will be in the state where it was shrunken rather than the case where the reflected figure y of the ring shape target 53 shows drawing 9, and the reflected figures alpha and beta by the pinholes 58 and 59 will be in the state where it is located in the outside of the reflected figure y.
[0056]The relation between the reflected figures alpha and beta by such pinholes 58 and 59, and the reflected figure y of the ring shape target 53, It memorizes to the storage parts store which is not illustrated, and data processing of the distance over the optometry E-ed

of a Z direction is carried out by the image processing portion 81, the distance turns into a constant distance, or fine alignment of the optical axis direction of a Z direction is performed so that it may enter in a fixed range.

[0057]The embodiment of the invention 2 is described with reference to (Embodiment 2) next drawing 12, and drawing 13. In drawing 12 and drawing 13, the same numerals are attached and shown in the same element as the composition of Embodiment 1 shown in drawing 3 thru/or drawing 6.

[0058]Although fundamental composition is the same as that of the case of Embodiment 1, the ophthalmology device of this Embodiment 2 shown in drawing 12 and drawing 13, As shown in drawing 12, while omitting said contact sensor 125, as shown in drawing 13, The direction motor 131d of X, the direction motor 131e of Y which consist of DC motors as a driving source, It is the feature to have added the three overcurrent sensing circuits 152a, 152b, and 152c as an overcurrent detecting means which detects the over-current which adopts the Z direction motor 131f, and is produced in the direction motor 131d of X, the direction motor 131e of Y, and Z direction motor 131f of each to the control system. The timer 144 which clocks time can also be added to the control section 140.

[0059]According to this composition, in the crevice G between said trestle part 103 and the optical system moving section 104 For example, when the foreign matters 150, such as a finger of the subject, invade, Although the foreign matters 150, such as a finger, are pushed in said crevice G by the driving force of the direction motor 131d of X which consists of said DC motor and an over-current flows into said direction motor 131d of X, The overcurrent sensing circuit 152a detects this state, and the control section 140 carries out drive controlling of said direction motor 131d of X based on the detection result of the overcurrent sensing circuit 152a, It changes into the state where the interval of the crevice G between said trestle part 103 and the optical system moving section 104 is not pressed like the case where said foreign matter 150 is mentioned already. By this, the thrust to the foreign matters 150, such as a finger, can be eliminated, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at. In operation of said timer 144, the direction motor 131d of X can be stopped after specified time elapse.

[0060]The embodiment of the invention 3 is described with reference to (Embodiment 3) next drawing 14, and drawing 15. In drawing 14 and drawing 15, the same numerals are attached and shown in the same element as the composition of Embodiment 1 shown in drawing 3 thru/or drawing 6.

[0061]Although fundamental composition is the same as that of the case of Embodiment 1, the ophthalmology device of this Embodiment 3 shown in drawing 14 and drawing 15, As the optical system actuator 130A replaced with the optical system actuator 130 as shown in drawing 14, As shown in having connected said follower gear 136 and the screw body 135 via the friction clutch 137 which constitutes a clutch mechanism (each drive mechanism of the direction of Y and a Z direction is also the same), and drawing 15, It is the feature to have added the slide sensors (for example, heat sensor) 155a thru/or 155c which detect the slide generation state of each friction clutch 137 corresponding to each drive mechanism of the direction of X, the direction of Y, and a Z direction.

[0062]According to this composition, in the crevice G between said trestle part 103 and the optical system moving section 104 For example, when the foreign matters 150, such

as a finger of the subject, invade, Can buffer transfer of the driving force from said direction motor 131a of X by the clutch operation of said friction clutch 137 to the optical system moving section 104, can ease an operation of the excessive thrust to the foreign matters 150, such as a finger, and the damage is avoided, Improvement in the safety of this ophthalmology device can be aimed at after all. Of course, the measure of suspending said direction motor 131a of X based on the detection result of the slide generation state by the slide sensor 155a is also possible.

[0063]

[Effect of the Invention]According to the invention according to claim 1, also in the case where it is the contingency that foreign matters, such as fingers, such as subject, invade into the crevice between a trestle part and an optical system moving section, the damage over foreign matters, such as a finger, can be avoided and the ophthalmology device which can aim at improvement in safety can be provided.

[0064]Also in the case where it is the contingency that foreign matters, such as fingers, such as subject, invade into the crevice between a trestle part and an optical system moving section according to the invention according to claim 2, in the composition and the operation of a DC motor which are called overcurrent detection not using an exceptional sensor. The ophthalmology device which can eliminate the thrust to foreign matters, such as a finger, can avoid the damage, and can aim at improvement in safety can be provided.

[0065]According to the invention according to claim 3, in the crevice between a trestle part and an optical system moving section. For example, when foreign matters, such as a finger of the subject, invade, transfer of the driving force from said motor to an optical system moving section can be buffered according to a clutch mechanism, and the ophthalmology device which can ease an operation of the excessive thrust to foreign matters, such as a finger, and can avoid the damage can be provided.

TECHNICAL FIELD

[Field of the Invention]This invention relates to ophthalmology devices, such as a refractometer, keratometer, etc. which perform the rough alignment and fine alignment to optometry-ed of a device main frame, and perform examining-the eyes measurement [ophthalmology], in more detail about an ophthalmology device.

PRIOR ART

[Description of the Prior Art]the ophthalmology device which has what is called an automatic alignment function conventionally -- that is, The catoptric light from the cornea of the alignment-index light projected on optometry-ed is led to the photosensor of a light-receiving optical system, and the ophthalmology device which aligns a device main frame automatically to optometry-ed based on the detect output of this photosensor is known.

[0003]In this ophthalmology device, a ** person moves the measuring beam axis of a device main frame to near an examining-the eyes vertex-corneae point using a joy stick etc., looking at a picture monitor (rough alignment). Completion of rough alignment will perform detailed automatic alignment with a drive unit based on the output of a

photosensor (fine alignment). Thereby, a device main frame is arranged to a prescribed position to optometry-ed, and it is made to perform exact ophthalmology measurement.
[0004]The trestle part which such an ophthalmology device is supported movable by the support base established in the device main frame, and performs rough alignment to optometry-ed, Usually it has composition which has an optical system moving section which carries the optical system for optometry supported movable for right and left and up-and-down all directions to this trestle part approximately.

EFFECT OF THE INVENTION

[Effect of the Invention]According to the invention according to claim 1, also in the case where it is the contingency that foreign matters, such as fingers, such as subject, invade into the crevice between a trestle part and an optical system moving section, the damage over foreign matters, such as a finger, can be avoided and the ophthalmology device which can aim at improvement in safety can be providcd.
[0064]Also in the case where it is the contingency that foreign matters, such as fingers, such as subject, invade into the crevice between a trestle part and an optical system moving section according to the invention according to claim 2, in the composition and the operation of a DC motor which are called overcurrent detection not using an exceptional sensor. The ophthalmology device which can eliminate the thrust to foreign matters, such as a finger, can avoid the damage, and can aim at improvement in safety can be provided.
[0065]According to the invention according to claim 3, in the crevice between a trestle part and an optical system moving section. For example, when foreign matters, such as a finger of the subject, invade, transfer of the driving force from said motor to an optical system moving section can be buffered according to a clutch mechanism, and the ophthalmology device which can ease an operation of the excessive thrust to foreign matters, such as a finger, and can avoid the damage can be provided.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, in order to move an optical system moving section in the case of the conventional ophthalmology device mentioned above, between a trestle part and an optical system moving section, the structure blockaded thoroughly does not become but a certain amount of crevice exists. As a result, in the case where the subject of childhood gets into mischief near this ophthalmology device when setting by sending this ophthalmology device to a show for display, for example etc., The situation where a finger was inserted in said crevice arose, the crevice interval by movement of the optical system moving section to a trestle part became very narrow depending on the case, and there was a danger that the accident in which the amount of driving force to an optical system moving section will carry out a direct action to a finger, and a finger will be damaged would occur.
[0006]In light of the above-mentioned circumstances, also in the case where it is the contingency that foreign matters, such as fingers, such as subject, are inserted in the crevice between a trestle part and an optical system moving section, this invention avoids

the damage over foreign matters, such as a finger, and an object of this invention is to provide the ophthalmology device which can aim at improvement in safety.

MEANS

[Means for Solving the Problem]A trestle part to which the invention according to claim 1 is supported by support base movable, and this invention performs rough alignment to optometry-ed, An ophthalmology device which has the optical system moving section supported movable for right and left and up-and-down all directions is characterized by comprising the following approximately, having a crevice between this trestle part:
A detection means to detect existence of a foreign matter in a crevice between said trestle part and an optical system moving section.
An optical system actuator which drives said optical system moving section respectively for order, right and left, and up-and-down all directions, and performs fine alignment to optometry-ed.
A control means which changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section, based on a detection result of a foreign matter by said detection means.

[0008]According to this invention, when foreign matters, such as a finger of subject, are inserted in a crevice between said trestle part and an optical system moving section, for example, a detection means sends a detection result which shows existence of a foreign matter in this crevice to a control means. A control means changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section, based on a detection result of a foreign matter by a detection means.
[0009]Thereby, also in a case where it is the contingency that foreign matters, such as fingers, such as subject, are inserted in a crevice between a trestle part and an optical system moving section, damage over foreign matters, such as a finger, can be avoided and improvement in the safety of this ophthalmology device can be aimed at.
[0010]A trestle part to which the invention according to claim 2 is supported by support base movable, and this invention performs rough alignment to optometry-ed, An ophthalmology device which has the optical system moving section supported movable for right and left and up-and-down all directions is characterized by comprising the following approximately, having a crevice between this trestle part:
An optical system actuator using a DC motor which drives said optical system moving section respectively for order, right and left, and up-and-down all directions, and performs fine alignment to optometry-ed.
An overcurrent detecting means which detects an over-current to said DC motor which flows with invasion of a foreign matter to a crevice between said trestle part and an optical system moving section.
A control means which changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section, based on a detection result of an over-current by said overcurrent detecting means.

[0011]According to this invention, when foreign matters, such as a finger of subject, are inserted in a crevice between said trestle part and an optical system moving section, for example, foreign matters, such as a finger, are pushed in said crevice by driving force of said DC motor, and an over-current flows into said DC motor, but. Since an overcurrent detecting means detects this state and a control means changes said optical system actuator into the state where said foreign matter is not drive-controlling-pressed for a crevice interval between said trestle part and an optical system moving section, based on a detection result of an overcurrent detecting means, Also in a case where it is the contingency that foreign matters, such as fingers, such as subject, are inserted in a crevice between a trestle part and an optical system moving section, thrust to foreign matters, such as a finger, can be eliminated, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at.
[0012]A trestle part which the invention according to claim 3 is supported by support base movable, and performs rough alignment to optometry-ed, In an ophthalmology device which has the optical system moving section supported movable for right and left and up-and-down all directions approximately having a crevice between this trestle part, An optical system actuator using a motor and a clutch mechanism which give driving force for right and left and up-and-down all directions, and perform fine alignment to optometry-ed is respectively provided to said optical system moving section approximately, At the time of invasion of a foreign matter to a crevice between said trestle part and an optical system moving section, transfer of driving force from said motor to an optical system moving section was buffered according to said clutch mechanism.
[0013]Since according to this invention transfer of driving force from said motor to an optical system moving section was buffered according to said clutch mechanism when foreign matters, such as a finger of subject, invaded into a crevice between said trestle part and an optical system moving section, for example, An operation of excessive thrust to foreign matters, such as a finger, can be eased, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at too.
[0014]
[Embodiment of the Invention]Below, an embodiment of the invention is described in detail.
[0015](Embodiment 1) Drawing 1 is an outline view of the ophthalmology device which has a function of both the keratometer which is an example of an embodiment of the invention, and a refractometer.
[0016]As shown in drawing 1, this ophthalmology device is provided with the following.
The support base 100 which consists of the fixed base 101 and the moving base 102 where the device power which is not illustrated was built in.
The trestle part 103 provided with the indicator 82 which has been arranged on the moving base 102 of this support base 100 and which is mentioned later.
The optical system moving section 104 arranged movable in X (right and left) directions shown in drawing 1 to the trestle part 103 in the upper part of this trestle part 103, the direction of Y (upper and lower sides), and the direction of Z (before or after).
The jaw receptacle implement 105 with which the subject M connected with said fixed base 101 carries a jaw.

[0017]With the moving base 102, said trestle part 103 has become movable to the direction of X, and a Z direction by operation at the control lever 111, and said trestle part 103 is movable in the direction of Y to the moving base 102 by carrying out rotatably operating of the control lever 111. Explanation is omitted about the moving mechanism of the moving base 102 and the trestle part 103 here.
[0018]The operation switch 112 is formed in the center of a crowning of said control lever 111, and examining E-the eyes photography [picture] etc. are performed.
[0019]Drawing 2 shows the optical system of the ophthalmology device of this Embodiment 1, and equips the trestle part 103 and the optical system moving section 104 which are confronted with the optometry E-ed of the subject M with the optical element stated to the following which constitutes the optical path 1 thru/or the optical path 6.
[0020]The optical path 1 is an optical system for projecting the target for eye-refracting-power measurement on the optometry E-ed, and comprises the light source 11, the collimator lens 12, the cone prism 13, the measurement target 14, the relay lens 15, the pupil relay lens 16, the hole difference mirror 17, the mirrors 18 and 19, and the object lens 20.
[0021]The optical path 2 is an optical system for receiving the target image reflected from examining E-the eyes eyegrounds to the area sensor 28, It comprises the object lens 20, the mirrors 19 and 18, the hole difference mirror 17, the pupil relay lens 21, the mirror 22, the relay lens 23, the moving lens 24, the mirrors 25 and 26, the image formation lens 27, and the area sensor 28.
[0022]The optical path 3 is an optical system for observing an examining E-the eyes anterior ocular segment image, and comprises the area sensor 28 which consists of the object lens 20, the mirror 19, the diaphragms 31 and 32, the relay lens 33, the collimator lens 34, the mirror 26, the image formation lens 27, a CCD element, etc.
[0023]The image processing portion 81 which performs image processing of optometry data, and the indicator 82 which performs image display of an image for the eyes to be examined are connected to this area sensor 28.
[0024]The optical paths 4 are the fixation and an optical system for carrying out fog, and the optometry E-ed consists of the light source 41, the collimator lens 42, the fixation target 43, the relay lens 44, the pupil relay lens 45, the mirror 46, the mirror 18, the mirror 19, and the object lens 20.
[0025]The optical path 5 is an optical system for performing distance doubling of the optical axis direction of the optometry E-ed and a main part, It comprises the light source 51 which is in a view for the eyes to be examined and was put in order by ring shape, the diffusion board 52, the ring shape target 53, the light sources 54 and 55 for projecting a parallel pencil on the optometry E-ed and the diffusion boards 56 and 57, the pinholes 58 and 59, and the collimator lenses 60 and 61. The optical path 5 serves also as the optical system for measuring the curvature radius of an examining E-the eyes cornea.
[0026]The optical path 6 is constituted from the optical system for performing alignment of the direction which intersects perpendicularly with the optic axis of the optometry E-ed and a main part by the light source 71, the diffusion board 72, the pinhole 73, the collimator lens 74, the mirror 32, the diaphragm 31, the mirror 19, and the object lens 20.
[0027]Next, with reference to drawing 3 thru/or drawing 6, the joining structure of said trestle part 103 and the optical system moving section 104 in this Embodiment 1 is

explained.
[0028]Said trestle part 103 and the optical system moving section 104 covered the whole periphery abbreviation respectively, and are provided with the stand covering 123 and the optical system covering 124.
[0029]The stand covering 123 of said trestle part 103 is provided with the following.
While being constituted so that the wall surface which met in the direction of Y of this trestle part 103 may be covered as shown in drawing 3, it is the flat part 123a to the upper part side of the trestle part 103.
The square tubed rising part 123b which rises to the direction upper part of Y.
And in the opening region of the rising part 123b, said optical system moving section 104 is supported movable to the direction of X, the direction of Y, and the Z direction.
[0030]The optical system covering 124 of said optical system moving section 104 is provided with the following.
The flat upper face part 124a which covers the upper surface of the optical system moving section 104.
It is the wrap square tubed lateral portion 124b about the wall surface which met in the direction of Y of the optical system moving section 104.

[0031]Between said rising part 123b and the lateral portion 124b, the crevice (several millimeters thru/or about about ten mm) G is formed corresponding to the movement magnitude of the optical system moving section 104 to said trestle part 103.
[0032]And the wall surface perimeter of said rising part 123b which faces this crevice G, and the lateral portion 124b was covered, and the contact sensor 125 which does not send current through the foreign matters 150, such as a finger, with an un-energizing type is arranged.
[0033]As the contact sensor 125, the photo sensor which put respectively in a row photo detectors which stuck the insulation sheet on the surface, such as light emitting devices, such as an electrostatic type sensor and LED, and a photo-transistor, to correspondence arrangement, for example is used. The composition arranged to [both sides or either one of] said rising part 123b or a lateral portion 124b can be used for the contact sensor 125.
[0034]Said optical system moving section 104 is driven in the direction of X by the optical system actuator 130 arranged on the trestle part 103, and performs fine alignment to the optometry E-ed.
[0035]Namely, the direction motor 131a of X which consists of a pulse motor arranged on the upper surface of said trestle part 103 as the optical system actuator 130 is shown in drawing 4 and drawing 5, The motivation gear 132 connected with the driving shaft of this direction motor 131a of X is arranged, It meets in the direction of X by the pieces 133 and 134 of a screw receptacle of the couple which protruded on the wall surface which met in the direction of X of the optical system actuator 130, And the screw body 135 which was screwed in the pieces 133 and 134 of these screw receptacles and which was formed cylindrically is arranged, and it has structure which screwed the follower gear 136 attached to the end of this screw body 135, and said motivation gear 132.
[0036]Although the optical system actuator which drives said optical system moving section 104 to the direction of Y and a Z direction is not illustrated, either, it is considered as the same composition as said optical system actuator 130.
[0037]Drawing 6 shows the principal part of the control system in this Embodiment 1,

and it is provided with the control section 140 as a control means which controls said contact sensor 125 and the direction motor 131a of X while it stores the control program about rough alignment, fine alignment, etc. to the optometry E-ed. This control section 140 controls the direction motor 131b of Y and the Z direction motor 131c which constitute each optical system actuator which drives said optical system moving section 104 besides said direction motor 131a of X to the direction of Y, and a Z direction.

[0038]Next, the case where the foreign matters 150, such as a finger of the child of childhood, invade an operation of the ophthalmology device of this Embodiment 1 into the crevice G between said rising part 123b and the lateral portion 124b is mainly carried out, and it explains.

[0039]When the foreign matters 150, such as a finger of the child of childhood, invade into the crevice G between the rising part 123b of said trestle part 103, and the lateral portion 124b of the optical system moving section 104, said contact sensor 125 operates and the detection result which shows existence of the foreign matter 150 is sent to the control section 140. In this case, since said contact sensor 125 is constituted in the un-energizing type, current does not flow into human bodies, such as a finger of the child of childhood, and it excels in safety extremely.

[0040]Based on the detection result from the contact sensor 125, said control section 140 stops said direction motor 131a of X, and loses the thrust to the foreign matters 150, such as a finger. the direction which the control section 140 performs movement to the initial setting position (for example, center position) of said optical system moving section 104 based on the detection result from the contact sensor 125, or keeps away said optical system moving section 104 from the foreign matter 150 -- it is made to move

[0041]Thereby, also in the case where it is the contingency that the foreign matters 150, such as fingers, such as subject, invade into the crevice G between the trestle part 103 and the optical system moving section 104, the thrust to the foreign matters 150, such as a finger, can be eliminated, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at.

[0042]Next, with reference to drawing 7 thru/or drawing 11, the alignment operation which consists of the rough alignment and fine alignment by the ophthalmology device of the above-mentioned composition is explained.

[0043]For example, in the case where the mode which aligns focusing on an examining E-the eyes cornea is chosen by a ** person's operation, the procedure of performing alignment to the optometry E-ed of the trestle part 103 is explained.

[0044]It intersects perpendicularly with the optic axis which the optical system of the trestle part 103 and the optical system moving section 104 forms, for example, auto alignment about the direction of X is performed by the principle expressed below.

[0045]That is, the light flux which was emitted from the light source 71 of the optical path 6, and was ejected from the pinhole 73 is projected as a parallel pencil to the optometry E-ed, and is reflected by the examining E-the eyes cornea.

[0046]The reflected figure of the light flux ejected from the pinhole 73 from a cornea is projected by each optical element of the optical path 3 on the area sensor 28.

[0047]When there is a gap in the optical path 3 and an examining E-the eyes optical axis, it is displayed in the state where it shifted from the center as the reflected figure x of the light flux ejected from the pinhole 73 to the pupil portion in an examining E-the eyes anterior ocular segment image showed drawing 7.

[0048]When there is no gap in said optical path 3 and an examining E-the eyes optical axis, the reflected figure x of the light flux ejected from the pinhole 73 to the pupil portion in an examining E-the eycs anterior ocular segment image is displayed on the center position, as shown in drawing 8.
[0049]Said reflected figure projected on the area sensor 28 is memorized by the storage parts store 83 of the image processing portion 81, and data processing of the gap with the optic axis of the optical path 3 and an examining E-the eyes optical axis is carried out by the image processing portion 81.
[0050]A ** person performs rough alignment, looking at examining E-the eyes the anterior ocular segment image and the reflected figure x which are observed by the optical path 3 and displayed on the indicator 82.
[0051]And if the reflected figure x goes into a prescribed range, the optical system moving section 104 will be moved based on data processing by said image processing portion 81. Thereby, examining E-the eyes alignment [fine] is completed automatically.
[0052]On the other hand, the alignment to an examining E-the eyes Z direction uses the optical path 5. That is, projection of the light flux from the ring shape target 53 from limited distance and parallel projection of the light flux ejected from the pinholes 58 and 59 are performed by the composition of the optical path 5 to an examining E-the eyes cornea.
[0053]The reflected figure from an examining E-according to two kinds of this projection-the eyes cornea is projected on the area sensor 28 by the optical path 3. When the distance of the optometry E-ed and the main part 50 is in a normal position value, here, The display mode of the reflected figures alpha and beta by the pinholes 58 and 59 displayed on said indicator 82 and the reflected figure y of the ring shape target 53 will be in the state where the reflected figures alpha and beta were in agreement with the circumference section of the reflected figure y by arrangement 180 degrees, as [show / in drawing 9].
[0054]When the distance of the optometry E-ed and the trestle part 103 is too nearer than a normal position value, The display mode of the reflected figures alpha and beta by the pinholes 58 and 59 displayed on said indicator 82, and the reflected figure y of the ring shape target 53, As shown in drawing 10, it spreads rather than the case where the reflected figure y of the ring shape target 53 shows drawing 9, and the reflected figures alpha and beta by the pinholes 58 and 59 will be in the state where it is located inside the reflected figure y.
[0055]When distance with the optometry E-ed is too further than a normal position value, The display mode of the reflected figures alpha and beta by the pinholes 58 and 59 displayed on said indicator 82, and the reflected figure y of the ring shape target 53, As shown in drawing 11, it will be in the state where it was shrunken rather than the case where the reflected figure y of the ring shape target 53 shows drawing 9, and the reflected figures alpha and beta by the pinholes 58 and 59 will be in the state where it is located in the outside of the reflected figure y.
[0056]The relation between the reflected figures alpha and beta by such pinholes 58 and 59, and the reflected figure y of the ring shape target 53, It memorizes to the storage parts store which is not illustrated, and data processing of the distance over the optometry E-ed of a Z direction is carried out by the image processing portion 81, the distance turns into a constant distance, or fine alignment of the optical axis direction of a Z direction is

performed so that it may enter in a fixed range.
[0057]The embodiment of the invention 2 is described with reference to (Embodiment 2) next drawing 12, and drawing 13. In drawing 12 and drawing 13, the same numerals are attached and shown in the same element as the composition of Embodiment 1 shown in drawing 3 thru/or drawing 6.
[0058]Although fundamental composition is the same as that of the case of Embodiment 1, the ophthalmology device of this Embodiment 2 shown in drawing 12 and drawing 13, As shown in drawing 12, while omitting said contact sensor 125, as shown in drawing 13, The direction motor 131d of X, the direction motor 131e of Y which consist of DC motors as a driving source, It is the feature to have added the three overcurrent sensing circuits 152a, 152b, and 152c as an overcurrent detecting means which detects the over-current which adopts the Z direction motor 131f, and is produced in the direction motor 131d of X, the direction motor 131e of Y, and Z direction motor 131f of each to the control system. The timer 144 which clocks time can also be added to the control section 140.
[0059]According to this composition, in the crevice G between said trestle part 103 and the optical system moving section 104 For example, when the foreign matters 150, such as a finger of the subject, invade, Although the foreign matters 150, such as a finger, are pushed in said crevice G by the driving force of the direction motor 131d of X which consists of said DC motor and an over-current flows into said direction motor 131d of X, The overcurrent sensing circuit 152a detects this state, and the control section 140 carries out drive controlling of said direction motor 131d of X based on the detection result of the overcurrent sensing circuit 152a, It changes into the state where the interval of the crevice G between said trestle part 103 and the optical system moving section 104 is not pressed like the case where said foreign matter 150 is mentioned already. By this, the thrust to the foreign matters 150, such as a finger, can be eliminated, that damage can be avoided, and improvement in the safety of this ophthalmology device can be aimed at. In operation of said timer 144, the direction motor 131d of X can be stopped after specified time elapse.
[0060]The embodiment of the invention 3 is described with reference to (Embodiment 3) next drawing 14, and drawing 15. In drawing 14 and drawing 15, the same numerals are attached and shown in the same element as the composition of Embodiment 1 shown in drawing 3 thru/or drawing 6.
[0061]Although fundamental composition is the same as that of the case of Embodiment 1, the ophthalmology device of this Embodiment 3 shown in drawing 14 and drawing 15, As the optical system actuator 130A replaced with the optical system actuator 130 as shown in drawing 14, As shown in having connected said follower gear 136 and the screw body 135 via the friction clutch 137 which constitutes a clutch mechanism (each drive mechanism of the direction of Y and a Z direction is also the same), and drawing 15, It is the feature to have added the slide sensors (for example, heat sensor) 155a thru/or 155c which detect the slide generation state of each friction clutch 137 corresponding to each drive mechanism of the direction of X, the direction of Y, and a Z direction.
[0062]According to this composition, in the crevice G between said trestle part 103 and the optical system moving section 104 For example, when the foreign matters 150, such as a finger of the subject, invade, Can buffer transfer of the driving force from said direction motor 131a of X by the clutch operation of said friction clutch 137 to the optical

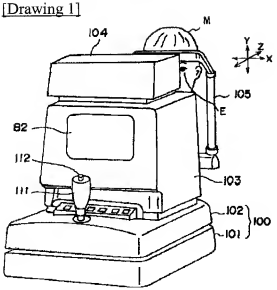
system moving section 104, can ease an operation of the excessive thrust to the foreign matters 150, such as a finger, and the damage is avoided, Improvement in the safety of this ophthalmology device can be aimed at after all. Of course, the measure of suspending said direction motor 131a of X based on the detection result of the slide generation state by the slide sensor 155a is also possible.

[Brief Description of the Drawings]
[Drawing 1]It is a perspective view showing the appearance of the auto KERATO refractometer of the embodiment of the invention 1.
[Drawing 2]It is an optical lineblock diagram of the auto KERATO refractometer which can be set this embodiment 1.
[Drawing 3]It is an outline sectional view showing the trestle part of the auto KERATO refractometer of this Embodiment 1, and an optical system moving section.
[Drawing 4]It is an outline top view showing the trestle part, optical system moving section, and optical system actuator of an auto KERATO refractometer of this Embodiment 1.
[Drawing 5]It is an A-A line sectional view of drawing 4.
[Drawing 6]It is a block diagram showing the control system of the auto KERATO refractometer of this Embodiment 1.
[Drawing 7]It is an explanatory view showing the display mode of the anterior ocular segment image in the embodiment of the invention 1, and the pinhole image which carried out the position gap.
[Drawing 8]It is an explanatory view showing the display mode of a pinhole image without the anterior ocular segment image and position gap in the embodiment of the invention 1.
[Drawing 9]It is an explanatory view showing the display mode of the anterior ocular segment image in the embodiment of the invention 1, a pinhole image, and a ring shape target image.
[Drawing 10]It is an explanatory view showing the display mode of the anterior ocular segment image in the embodiment of the invention 1, a pinhole image, and a ring shape target image.
[Drawing 11]It is an explanatory view showing the display mode of the anterior ocular segment image in the embodiment of the invention 1, a pinhole image, and a ring shape target image.
[Drawing 12]It is an outline sectional view showing the trestle part of the embodiment of the invention 2, and an optical system moving section.
[Drawing 13]It is a block diagram showing the control system in the embodiment of the invention 2.
[Drawing 14]It is an outline top view showing the trestle part in the embodiment of the invention 3, an optical system moving section, and an optical system actuator.
[Drawing 15]It is a block diagram showing the control system in the embodiment of the invention 3.
[Description of Notations]
20 Object lens
28 Area sensor
82 Indicator

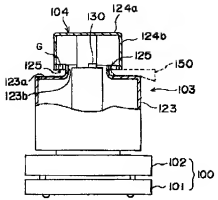
100 Support base
101 Fixed base
102 Moving base
103 Trestle part
104 Optical system moving section
111 Control lever
112 Operation switch
123 Stand covering
124 Optical system covering
125 Contact sensor
130 Optical system actuator
131a The direction motor of X
131b The direction motor of Y
131c Z direction motor
132 Motivation gear
135 Screw body
136 Follower gear
137 Friction clutch
140 Control section
144 Timer
150 Foreign matter
152a Overcurrent sensing circuit

DRAWINGS

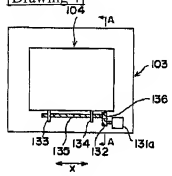
[Drawing 1]



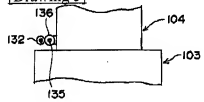
[Drawing 3]



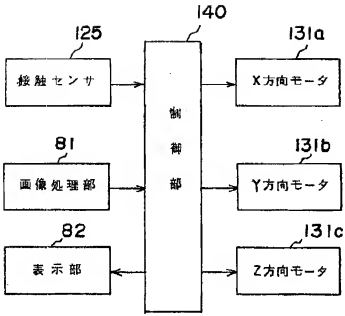
[Drawing 4]



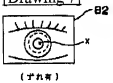
[Drawing 5]



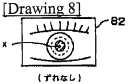
[Drawing 6]



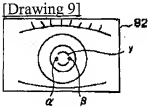
[Drawing 7]



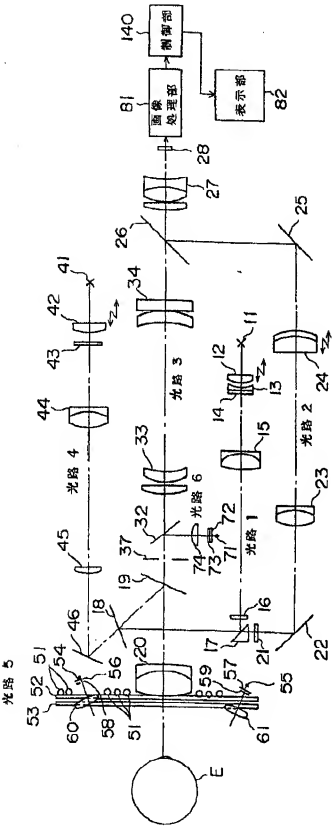
[Drawing 8]



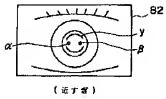
[Drawing 9]



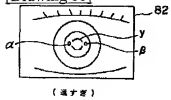
[Drawing 2]



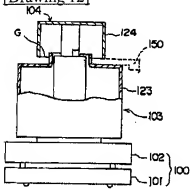
[Drawing 10]



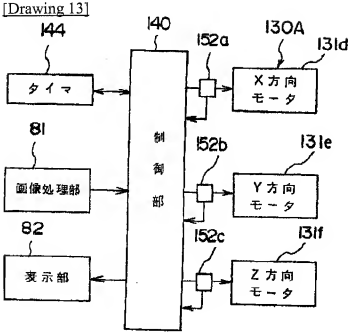
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Drawing 14]

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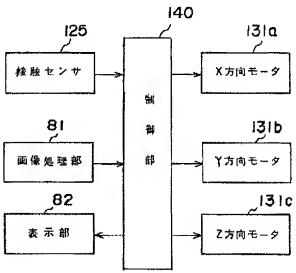
(71)出願人　000220343
株式会社トプコン
東京都板橋区蓮沼町75番１号
(72)発明者　原　邦彦
東京都板橋区蓮沼町75番１号　株式会社トプコン内
(72)発明者　高木　和俊
東京都板橋区蓮沼町75番１号　株式会社トプコン内
(74)代理人　弁理士　三澤　正義

(54)【発明の名称】　眼科装置

(57)【要約】
【課題】　本発明は、指等の異物に対する損傷を回避し、安全性の向上を図れる眼科装置を提供する。
【解決手段】　支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部との間に隙間を有しつつ、前後、左右及び上下各方向に移動可能に支持された光学系移動部とを有する眼科装置において、前記架台部と光学系移動部との間の隙間における異物の存在を検出する接触センサ１２５と、前記光学系移動部を各々前後、左右及び上下各方向に駆動して被検眼に対する微アライメントを実行するＸ方向モータ１３１ａと、前記接触センサ１２５による異物の検出結果を基に前記Ｘ方向モータ１３１ａを駆動制御し、前記架台部と光学系移動部との間の隙間間隔を　前記異物を押圧しない状態に変更する制御部１４０とを設けたものである。



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【特許請求の範囲】

【請求項１】　支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部との間に隙間を有しつつ前後、左右及び上下各方向に移動可能に支持された光学系移動部とを有する眼科装置において、

前記架台部と光学系移動部との間の隙間における異物の存在を検出する検出手段と、

前記光学系移動部を各々前後、左右及び上下各方向に駆動して被検眼に対する微アライメントを実行する光学系駆動部と、

前記検出手段による異物の検出結果を基に前記光学系駆動部を駆動制御し、前記架台部と光学系移動部との間の隙間間隔を、前記異物を押圧しない状態に変更する制御手段と、

を設けたことを特徴とする眼科装置。

【請求項２】　支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部との間に隙間を有しつつ前後、左右及び上下各方向に移動可能に支持された光学系移動部とを有する眼科装置において、

前記光学系移動部を各々前後、左右及び上下各方向に駆動して被検眼に対する微アライメントを実行するＤＣモータを用いた光学系駆動部と、

前記架台部と光学系移動部との間の隙間への異物の侵入に伴って流れる前記ＤＣモータへの過電流を検出する過電流検出手段と、

前記過電流検出手段による過電流の検出結果を基に前記光学系駆動部を駆動制御し、前記架台部と光学系移動部との間の隙間間隔を、前記異物を押圧しない状態に変更する制御手段と、

を設けたことを特徴とする眼科装置。

【請求項３】　支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部との間に隙間を有しつつ前後、左右及び上下各方向に移動可能に支持された光学系移動部とを有する眼科装置において、

前記光学系移動部に対して各々前後、左右及び上下各方向に駆動力を付与して被検眼に対する微アライメントを実行するモータ及びクラッチ機構を用いた光学系駆動部を具備し、

前記架台部と光学系移動部との間の隙間への異物の侵入時に、前記クラッチ機構により前記モータから光学系移動部への駆動力の伝達を緩衝するようにしたことを特徴とする眼科装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、眼科装置に関し、より詳しくは、装置本体の被検眼に対する粗アライメント及び微アライメントを実行し、被検眼の眼科測定を実

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行するレフラクトメータ、ケラトメータ等の眼科装置に関する。

【０００２】

【従来の技術】従来、いわゆる自動アライメント機能を有する眼科装置、すなわち、被検眼に投影されたアライメント指標光の角膜からの反射光を、受光光学系の光センサに導き、この光センサの検出出力を基にして被検眼に対して装置本体を自動的にアライメントする眼科装置が知られている。

【０００３】かかる眼科装置においては、検者は画像モニタを見ながらジョイスティック等を使用して装置本体の測定光軸を被検眼の角膜頂点付近まで移動させる（粗アライメント）。また、粗アライメントが完了すると、光センサの出力を基にして駆動ユニットにより微細な自動アライメントを実行する（微アライメント）。これにより、装置本体を被検眼に対して所定位置に配置し正確な眼科測定を実行するようにしている。

【０００４】このような眼科装置は、装置本体に設けた支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部に対して前後、左右及び上下各方向に移動可能に支持された検眼用の光学系を搭載した光学系移動部とを有する構成とするのが通常である。

【０００５】

【発明が解決しようとする課題】しかしながら、上述した従来の眼科装置の場合、光学系移動部を移動させるために、架台部と光学系移動部との間は完全に閉塞された構造とはならずある程度の隙間が存在する。この結果、例えば、この眼科装置を展示会に出展してセッティングを行う場合、幼少の被検者がこの眼科装置の付近で悪戯を行う場合等において、前記隙間に指が挿入される事態が生じ、場合によっては架台部に対する光学系移動部の移動による隙間間隔が極めて狭小となり、光学系移動部に対する駆動力量が指に直接作用して指が損傷してしまうという事故が発生する危険性があった。

【０００６】本発明は、上記事情に鑑みてなされたものであり、架台部と光学系移動部との間の隙間に被検者等の指等の異物が挿入されるという不測の場合においても、指等の異物に対する損傷を回避し、安全性の向上を図れる眼科装置を提供することを目的とするものである。

【０００７】

【課題を解決するための手段】請求項１記載の発明は、支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部との間に隙間を有しつつ、前後、左右及び上下各方向に移動可能に支持された光学系移動部とを有する眼科装置において、前記架台部と光学系移動部との間の隙間における異物の存在を検出する検出手段と、前記光学系移動部を各々前後、左右及び上下各方向に駆動して被検眼に対する微アライ

メントを実行する光学系駆動部と、前記検出手段による異物の検出結果を基に前記光学系駆動部を駆動制御し、前記架台部と光学系移動部との間の隙間間隔を、前記異物を押圧しない状態に変更する制御手段とを設けたことを特徴とするものである。

【０００８】この発明によれば、前記架台部と光学系移動部との間の隙間に、例えば被検者の指等の異物が挿入された時、検出手段は、この隙間における異物の存在を示す検出結果を制御手段に送る。制御手段は、検出手段による異物の検出結果を基に前記光学系駆動部を駆動制御し、前記架台部と光学系移動部との間の隙間間隔を、前記異物を押圧しない状態に変更する。

【０００９】これにより、架台部と光学系移動部との間の隙間に被検者等の指等の異物が挿入されるという不測の場合においても、指等の異物に対する損傷を回避し、この眼科装置の安全性の向上を図ることができる。

【００１０】請求項２記載の発明は、支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部との間に隙間を有しつつ、前後、左右及び上下各方向に移動可能に支持された光学系移動部とを有する眼科装置において、前記光学系移動部を各々前後、左右及び上下各方向に駆動して被検眼に対する微アライメントを実行するＤＣモータを用いた光学系駆動部と、前記架台部と光学系移動部との間の隙間への異物の侵入に伴って流れる前記ＤＣモータへの過電流を検出する過電流検出手段と、前記過電流検出手段による過電流の検出結果を基に前記光学系駆動部を駆動制御し、前記架台部と光学系移動部との間の隙間間隔を、前記異物を押圧しない状態に変更する制御手段とを設けたことを特徴とするものである。

【００１１】この発明によれば、前記架台部と光学系移動部との間の隙間に、例えば被検者の指等の異物が挿入された時、前記ＤＣモータの駆動力により指等の異物が前記隙間において押され、前記ＤＣモータへ過電流が流れるが、この状態を過電流検出手段が検出し、制御手段が過電流検出手段の検出結果を基に前記光学系駆動部を駆動制御し、前記架台部と光学系移動部との間の隙間間隔を、前記異物を押圧しない状態に変更するので、架台部と光学系移動部との間の隙間に被検者等の指等の異物が挿入されるという不測の場合においても、指等の異物に対する押圧力を無くしてその損傷を回避しこの眼科装置の安全性の向上を図ることができる。

【００１２】請求項３記載の発明は、支持基部により移動可能に支持され被検眼に対する粗アライメントを行う架台部と、この架台部との間に隙間を有しつつ、前後、左右及び上下各方向に移動可能に支持された光学系移動部とを有する眼科装置において、前記光学系移動部に対して各々前後、左右及び上下各方向に駆動力を付与して被検眼に対する微アライメントを実行するモータ及びクラッチ機構を用いた光学系駆動部を具備し、前記架台部と光学系移動部との間の隙間への異物の侵入時に、前記クラッチ機構により前記モータから光学系移動部への駆動力の伝達を緩衝するようにしたことを特徴とするものである。

【００１３】この発明によれば、前記架台部と光学系移動部との間の隙間に、例えば被検者の指等の異物が侵入した時、前記クラッチ機構により前記モータから光学系移動部への駆動力の伝達を緩衝するようにしたので、指等の異物に対する過度の押圧力の作用を緩和してその損傷を回避することができ、やはりこの眼科装置の安全性の向上を図ることができる。

【００１４】

【発明の実施の形態】以下に、本発明の実施の形態を詳細に説明する。

【００１５】（実施の形態１）図１は本発明の実施の形態の一例であるケラトメータ、レフラクトメータ双方の機能を有する眼科装置の外観図である。

【００１６】図１に示すように、この眼科装置は、図示しない装置電源が内蔵された固定基部１０１及び移動基部１０２からなる支持基部１００と、この支持基部１００の移動基部１０２上に配置した後述する表示部８２を備えた架台部１０３と、この架台部１０３の上部において架台部１０３に対して図１に示すＸ（左右）方向、Ｙ（上下）方向、Ｚ（前後）方向に移動可能に配置した光学系移動部１０４と、前記固定基部１０１に連結した被検者Ｍが顎を載せる顎受け具１０５とを有している。

【００１７】前記架台部１０３は移動基部１０２とともに、操作レバー１１１に操作によりＸ方向、Ｚ方向に移動可能となっており、また、前記架台部１０３は操作レバー１１１を回転操作することで移動基部１０２に対してＹ方向に移動可能となっている。尚、移動基部１０２、架台部１０３の移動機構についてはここでは説明を省略する。

【００１８】前記操作レバー１１１の頂部中央には、操作スイッチ１１２が設けられ、被検眼Ｅの画像撮影等を行なうようになっている。

【００１９】図２は、本実施の形態１の眼科装置の光学系を示すものであり、被検者Ｍの被検眼Ｅに対峙させる架台部１０３及び光学系移動部１０４に、光路１乃至光路６を構成する以下に述べる光学素子を備えている。

【００２０】光路１は、被検眼Ｅに眼屈折力測定用の視標を投影するための光学系で、光源１１、コリメーターレンズ１２、円錐プリズム１３、測定ターゲット１４、リレーレンズ１５、瞳リレーレンズ１６、穴開きミラー１７、ミラー１８、１９、対物レンズ２０で構成されている。

【００２１】光路２は、被検眼Ｅの眼底から反射した視標像をエリアセンサ２８に受光する為の光学系で、対物レンズ２０、ミラー１９、１８、穴開きミラー１７、瞳リレーレンズ２１、ミラー２２、リレーレンズ２３、移

動レンズ２４、ミラー２５、２６、結像レンズ２７、エリアセンサ２８で構成されている。

【００２２】光路３は、被検眼Ｅの前眼部像を観察するための光学系で、対物レンズ２０、ミラー１９、絞り３１、３２、リレーレンズ３３、コリメーターレンズ３４、ミラー２６、結像レンズ２７、ＣＣＤ素子等からなるエリアセンサ２８で構成されている。

【００２３】このエリアセンサ２８には、被検眼データの画像処理を行う画像処理部８１、被検眼像の画像表示を行う表示部８２を接続している。

【００２４】光路４は、被検眼Ｅを固視、雲霧させる為の光学系で、光源４１、コリメーターレンズ４２、固視標４３、リレーレンズ４４、瞳リレーレンズ４５、ミラー４６、ミラー１８、ミラー１９、対物レンズ２０で構成されている。

【００２５】光路５は、被検眼Ｅと本体の光軸方向の距離合わせを行う為の光学系で、被検眼眼前にあってリング状に並べられた光源５１、拡散板５２、リング状視標５３と、被検眼Ｅに平行光束を投影するための光源５４、５５、拡散板５６、５７、ピンホール５８、５９、コリメーターレンズ６０、６１で構成されている。又、光路５は、被検眼Ｅの角膜の曲率半径を測定する為の光学系も兼ねている。

【００２６】光路６は、被検眼Ｅと本体の光軸に直交する方向の位置合わせを行う為の光学系で光源７１、拡散板７２、ピンホール７３、コリメーターレンズ７４、ミラー３２、絞り３１、ミラー１９、対物レンズ２０で構成されている。

【００２７】次に、図３乃至図６を参照して、本実施の形態１における前記架台部１０３と光学系移動部１０４との連結構造について説明する。

【００２８】前記架台部１０３及び光学系移動部１０４は、各々外周略全体に亘って架台カバー１２３、光学系カバー１２４を備えている。

【００２９】前記架台部１０３の架台カバー１２３は、図３に示すように、この架台部１０３のＹ方向に沿った壁面を覆うように構成されるとともに架台部１０３の上部側に、平坦部１２３ａと、Ｙ方向上方に立ち上がる四角筒状の立ち上げ部１２３ｂとを具備している。そして、立ち上げ部１２３ｂの開口領域において、前記光学系移動部１０４を、Ｘ方向、Ｙ方向、Ｚ方向に移動可能に支持している。

【００３０】また、前記光学系移動部１０４の光学系カバー１２４は、光学系移動部１０４の上面を覆う平坦な上面部１２４ａと、光学系移動部１０４のＹ方向に沿った壁面を覆う四角筒状の側面部１２４ｂとを具備している。

【００３１】前記立ち上げ部１２３ｂと、側面部１２４ｂとの間には、前記架台部１０３に対する光学系移動部１０４の移動量に対応して数ｍｍ乃至十数ｍｍ程度の隙間Ｇが形成されるようになっている。

【００３２】そして、この隙間Ｇに臨む前記立ち上げ部１２３ｂ、側面部１２４ｂの壁面全周に亘って、非通電型で指等の異物１５０に電流を流すことのない接触センサ１２５を配置している。

【００３３】接触センサ１２５としては、例えば、表面に絶縁シートを貼った静電型センサやＬＥＤ等の発光素子、フォトトランジスタ等の受光素子を各々対応配置に連れた光学センサを使用する。接触センサ１２５は、前記立ち上げ部１２３ｂ、側面部１２４ｂの双方又はいずれか一方に配置する構成を採用することができる。

【００３４】前記光学系移動部１０４は、架台部１０３上に配置した光学系駆動部１３０によりＸ方向に駆動され被検眼Ｅに対する微アライメントを実行するようになっている。

【００３５】即ち、光学系駆動部１３０は、図４、図５に示すように、前記架台部１０３の上面に配置したパルスモータからなるＸ方向モータ１３１ａと、このＸ方向モータ１３１ａの原動軸に連結した原動ギヤ１３２とが配置され、また、光学系駆動部１３０のＸ方向に沿った壁面に突設した一対のネジ受け片１３３、１３４によりＸ方向に沿って、かつ、これらネジ受け片１３３、１３４に螺合した棒状に形成されたネジ体１３５を配置し、このネジ体１３５の一端に取り付けた従動ギヤ１３６と前記原動ギヤ１３２とを螺合した構造となっている。

【００３６】前記光学系移動部１０４をＹ方向、Ｚ方向に駆動する光学系駆動部も、図示していないが前記光学系駆動部１３０と同様な構成としている。

【００３７】図６は、本実施の形態１における制御系の主要部を示すものであり、被検眼Ｅに対する粗アライメント、微アライメント等に関する制御プログラムを格納するとともに前記接触センサ１２５、Ｘ方向モータ１３１ａを制御する制御手段としての制御部１４０を備えている。この制御部１４０は、前記Ｘ方向モータ１３１ａの他、前記光学系移動部１０４をＹ方向、Ｚ方向に駆動する各光学系駆動部を構成するＹ方向モータ１３１ｂ、Ｚ方向モータ１３１ｃを制御するようになっている。

【００３８】次に、本実施の形態１の眼科装置の作用を、前記立ち上げ部１２３ｂと、側面部１２４ｂとの間の隙間Ｇに例えば幼少の子供の指等の異物１５０が侵入した場合を主にして説明する。

【００３９】前記架台部１０３の立ち上げ部１２３ｂと、光学系移動部１０４の側面部１２４ｂとの間の隙間Ｇに例えば幼少の子供の指等の異物１５０が侵入した時、前記接触センサ１２５が動作し、異物１５０の存在を示す検出結果を制御部１４０に送る。この場合、前記接触センサ１２５を非通電型に構成しているので、幼少の子供の指等の人体へ電流が流れることはなく、極めて安全性に優れている。

【００４０】前記制御部１４０は、接触センサ１２５か

らの検出結果を基に、前記Ｘ方向モータ１３１ａを停止させて指等の異物１５０に対する押圧力を無くす。また、制御部１４０は、接触センサ１２５からの検出結果を基に、前記光学系移動部１０４の初期設定位置（例えばセンター位置）への移動を行ったり、又は、前記光学系移動部１０４を異物１５０から遠ざかる方向への移動させる。

【００４１】これにより、架台部１０３と光学系移動部１０４との間の隙間Ｇに被検者等の指等の異物１５０が侵入するという不測の場合においても、指等の異物１５０に対する押圧力を無くしてその損傷を回避し、この眼科装置の安全性の向上を図ることができる。

【００４２】次に図７乃至図１１を参照して、上記構成の眼科装置による粗アライメント及び微アライメントからなるアライメント動作を説明する。

【００４３】例えば、検者の操作により、被検眼Ｅの角膜中心にアライメントをするモードが選択された場合において、架台部１０３の被検眼Ｅに対するアライメントを行う手順を説明する。

【００４４】架台部１０３、光学系移動部１０４の光学系が形成する光軸と直交する例えばＸ方向についてのオートアライメントは、以下に述べる原理により行われる。

【００４５】即ち、光路６の光源７１から放射され、ピンホール７３から射出された光束は、被検眼Ｅに対して平行光束として投影され、被検眼Ｅの角膜によって反射される。

【００４６】角膜からのピンホール７３から射出された光束の反射像は、光路３の各光学素子によりエリアセンサ２８上に投影される。

【００４７】光路３と被検眼Ｅの視軸とにずれがある場合、被検眼Ｅの前眼部像における瞳孔部分に対してピンホール７３から射出された光束の反射像ｘが図７に示すようにその中心からずれた状態で表示される。

【００４８】また、前記光路３と被検眼Ｅの視軸とにずれが無い場合、被検眼Ｅの前眼部像における瞳孔部分に対してピンホール７３から射出された光束の反射像ｘは図８に示すようにその中心位置に表示される。

【００４９】エリアセンサ２８上に投影された前記反射像は、画像処理部８１の記憶部８３に記憶され、画像処理部８１により光路３の光軸と被検眼Ｅの視軸とのずれが演算処理される。

【００５０】検者は、光路３によって観察され、かつ、表示部８２に表示される被検眼Ｅの前眼部像及び反射像ｘを見ながら粗アライメントを行う。

【００５１】そして、反射像ｘが所定範囲に入ると、前記画像処理部８１による演算処理に基づき、光学系移動部１０４を移動させる。これにより、被検眼Ｅの微アライメントが自動的に完了する。

【００５２】一方、被検眼ＥのＺ方向に対するアライメントは、光路５を用いる。即ち、光路５の構成により、被検眼Ｅの角膜に対して有限距離からのリング状視標５３からの光束の投影と、ピンホール５８、５９から射出される光束の平行投影とが行われる。

【００５３】この二種類の投影による被検眼Ｅの角膜からの反射像は、光路３によりエリアセンサ２８に投影される。ここで、被検眼Ｅと本体５０との距離が定位値にあるときには、前記表示部８２に表示されるピンホール５８、５９による反射像α、βと、リング状視標５３の反射像γとの表示態様は、図９に示すように、反射像γの円周部に１８０度配置で反射像α、βが一致した状態となる。

【００５４】また、被検眼Ｅと架台部１０３との距離が定位値より近すぎる場合には、前記表示部８２に表示されるピンホール５８、５９による反射像α、βと、リング状視標５３の反射像γとの表示態様は、図１０に示すように、リング状視標５３の反射像γが図９に示す場合よりも広がりピンホール５８、５９による反射像α、βが反射像γの内側に位置する状態となる。

【００５５】さらに、被検眼Ｅとの距離が定位値より遠すぎる場合には、前記表示部８２に表示されるピンホール５８、５９による反射像α、βと、リング状視標５３の反射像γとの表示態様は、図１１に示すように、リング状視標５３の反射像γが図９に示す場合よりも縮んだ状態となり、ピンホール５８、５９による反射像α、βが反射像γの外側に位置する状態となる。

【００５６】このようなピンホール５８、５９による反射像α、βと、リング状視標５３の反射像γとの関係を、図示しない記憶部に記憶し、画像処理部８１によりＺ方向の被検眼Ｅに対する距離を演算処理し、その距離が定距離になる又は一定範囲内に入るように、Ｚ方向の光軸方向の微アライメントを行う。

【００５７】（実施の形態２）次に、図１２、図１３を参照して本発明の実施の形態２を説明する。尚、図１２、図１３において、図３乃至図６に示す実施の形態１の構成と同一の要素には同一の符号を付して示す。

【００５８】図１２、図１３に示す本実施の形態２の眼科装置は、基本的構成は実施の形態１の場合と同様であるが、図１２に示すように前記接触センサ１２５を省略するとともに、図１３に示すように、駆動源としてＤＣモータからなるＸ方向モータ１３１ｄ、Ｙ方向モータ１３１ｅ、Ｚ方向モータ１３１ｆを採用し、かつ、Ｘ方向モータ１３１ｄ、Ｙ方向モータ１３１ｅ、Ｚ方向モータ１３１ｆ各々に生じる過電流を検出する過電流検出手段としての３個の過電流検出回路１５２ａ、１５２ｂ、１５２ｃを制御系に付加したことが特徴である。さらに、制御部１４０に時間を計時するタイマ１４４を付加することもできる。

【００５９】この構成によれば、前記架台部１０３と光学系移動部１０４との間の隙間Ｇに例えば被検者の指等

の異物１５０が侵入した時、前記ＤＣモータからなるＸ方向モータ１３１ｄの駆動力により指等の異物１５０が前記隙間Ｇにおいて押され、前記Ｘ方向モータ１３１ｄへ過電流が流れるが、この状態を過電流検出回路１５２ａが検出し、制御部１４０が過電流検出回路１５２ａの検出結果を基に前記Ｘ方向モータ１３１ｄを駆動制御し、前記架台部１０３と光学系移動部１０４との間の隙間Ｇの間隔を、前記異物１５０を既述した場合と同様にして押圧しない状態に変更する。これにより、指等の異物１５０に対する押圧力を無くしてその損傷を回避して、この眼科装置の安全性の向上を図ることができる。前記タイマ１４４の動作で、Ｘ方向モータ１３１ｄを所定時間経過後停止させるようにすることもできる。

【００６０】（実施の形態３）次に、図１４、図１５を参照して本発明の実施の形態３を説明する。尚、図１４、図１５において、図３乃至図６に示す実施の形態１の構成と同一の要素には同一の符号を付して示す。

【００６１】図１４、図１５に示す本実施の形態３の眼科装置は、基本的構成は実施の形態１の場合と同様であるが、図１４に示すように光学系駆動部１３０に代る光学系駆動部１３０Ａとして、前記従動ギヤ１３６とネジ体１３５とをクラッチ機構を構成する摩擦クラッチ１３７を介して連結したこと（Ｙ方向、Ｚ方向の各駆動機構も同様）、図１５に示すように、Ｘ方向、Ｙ方向、Ｚ方向の各駆動機構に対応して各摩擦クラッチ１３７の滑り発生状態を検出する滑りセンサ（例えば熱センサ）１５５ａ乃至１５５ｃを付加したことが特徴である。

【００６２】この構成によれば、前記架台部１０３と光学系移動部１０４との間の隙間Ｇに例えば被検者の指等の異物１５０が侵入した時、前記摩擦クラッチ１３７のクラッチ動作による前記Ｘ方向モータ１３１ａから光学系移動部１０４への駆動力の伝達を緩衝し、指等の異物１５０に対する過度の押圧力の作用を緩和することができ、その損傷を回避して、やはりこの眼科装置の安全性の向上を図ることができる。また、滑りセンサ１５５ａによる滑り発生状態の検出結果を基に前記Ｘ方向モータ１３１ａを停止する等の措置ももちろん可能である。

【００６３】

【発明の効果】請求項１記載の発明によれば、架台部と光学系移動部との間の隙間に被検者等の指等の異物が侵入するという不測の場合においても、指等の異物に対する損傷を回避し、安全性の向上を図ることができる眼科装置を提供することができる。

【００６４】請求項２記載の発明によれば、架台部と光学系移動部との間の隙間に被検者等の指等の異物が侵入するという不測の場合においても、格別のセンサを用いず、ＤＣモータの過電流検出という構成及び作用で、指等の異物に対する押圧力を無くしてその損傷を回避し安全性の向上を図ることができる眼科装置を提供することができる。

【００６５】請求項３記載の発明によれば、架台部と光学系移動部との間の隙間に、例えば被検者の指等の異物が侵入した時、クラッチ機構により前記モータから光学系移動部への駆動力の伝達を緩衝し、指等の異物に対する過度の押圧力の作用を緩和してその損傷を回避することができる眼科装置を提供することができる。

【図面の簡単な説明】

【図１】本発明の実施の形態１のオートケラトレフラクトメータの外観を示す斜視図である。

【図２】本実施の形態１におけるオートケラトレフラクトメータの光学構成図である。

【図３】本実施の形態１のオートケラトレフラクトメータの架台部、光学系移動部を示す概略断面図である。

【図４】本実施の形態１のオートケラトレフラクトメータの架台部、光学系移動部及び光学系駆動部を示す概略平面図である。

【図５】図４のＡ－Ａ線断面図である。

【図６】本実施の形態１のオートケラトレフラクトメータの制御系を示すブロック図である。

【図７】本発明の実施の形態１における前眼部像及び位置ずれしたピンホール像の表示態様を示す説明図である。

【図８】本発明の実施の形態１における前眼部像及び位置ずれのないピンホール像の表示態様を示す説明図である。

【図９】本発明の実施の形態１における前眼部像、ピンホール像、リング状視標像の表示態様を示す説明図である。

【図１０】本発明の実施の形態１における前眼部像、ピンホール像、リング状視標像の表示態様を示す説明図である。

【図１１】本発明の実施の形態１における前眼部像、ピンホール像、リング状視標像の表示態様を示す説明図である。

【図１２】本発明の実施の形態２の架台部、光学系移動部を示す概略断面図である。

【図１３】本発明の実施の形態２における制御系を示すブロック図である。

【図１４】本発明の実施の形態３における架台部、光学系移動部及び光学系駆動部を示す概略平面図である。

【図１５】本発明の実施の形態３における制御系を示すブロック図である。

【符号の説明】

２０　対物レンズ
２８　エリアセンサ
８２　表示部
１００　支持基部
１０１　固定基部
１０２　移動基部
１０３　架台部

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１０４　光学系移動部
１１１　操作レバー
１１２　操作スイッチ
１２３　架台カバー
１２４　光学系カバー
１２５　接触センサ
１３０　光学系駆動部
１３１ａ　Ｘ方向モータ
１３１ｂ　Ｙ方向モータ

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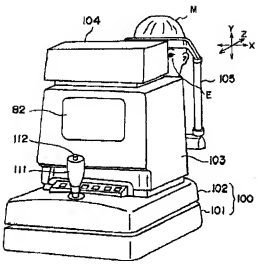
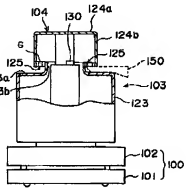
＊１３１ｃ　Ｚ方向モータ
１３２　原動ギヤ
１３５　ネジ体
１３６　従動ギヤ
１３７　摩擦クラッチ
１４０　制御部
１４４　タイマ
１５０　異物
＊　１５２ａ　過電流検出回路

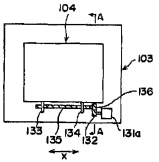
【図１】



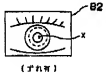
【図３】



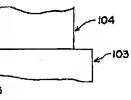
【図４】



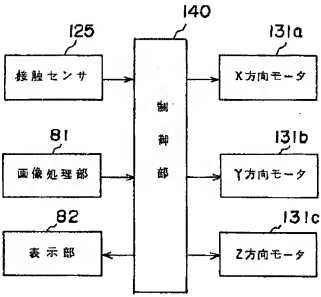
【図７】



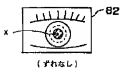
【図５】



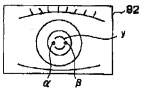
【図６】



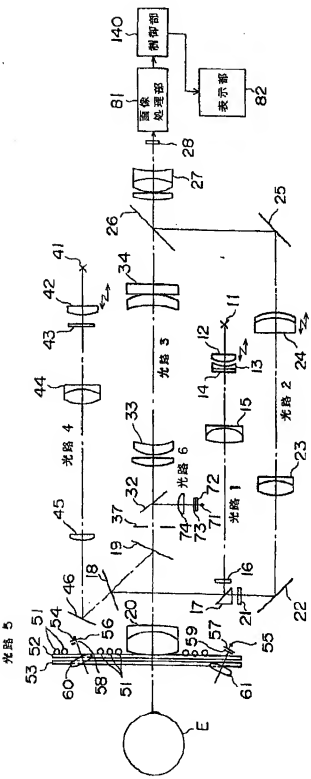
【図８】



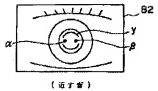
【図９】



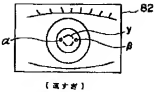
【図2】


140
制御部
81
画像処理部
82
表示部
28
27
26
25
41
42
34
43
44
光路 3
光路 4
12
11
13
24
14
15
33
光路 6
光路 1
光路 2
23
32
37
72
71
73
74
45
19
18
16
46
17
20
21
22
光路 5
51
52
53
54
56
59
57
55
60
58
61
E

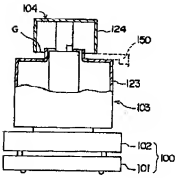
【図10】



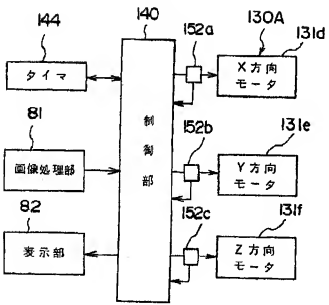
【図11】



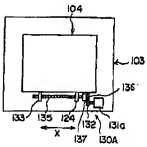
【図12】



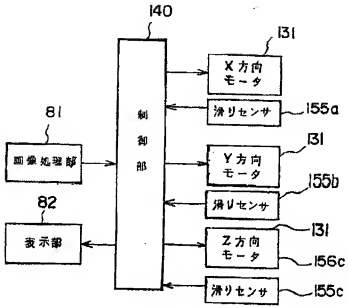
【図13】



【図14】



【図15】


140
131
X方向モータ
滑りセンサ
155a
81
画像処理部
制御部
131
Y方向モータ
155b
82
表示部
滑りセンサ
131
Z方向モータ
156c
滑りセンサ
155c